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THE LAKES BESIDE THE LOWER TARIM.

BY

DR. SVEN HEDIN.*

It was on the 6th and 7th December, 1899, that I passed the first links in the chain of curious lakes which stretches along the right bank of the Tarim after it turns to the southeast, or, generally speaking, along the stretch between Karaul and Arghan. These lakes are in every respect of such a strange and uncommon character that at the first glance it is impossible to understand how they can have originated or how the contours and the hydrographical relations of the region can have contributed to their formation. One would naturally suppose that, the river here washing the feet of sand-dunes 90 meters high, this would be precisely the last quarter in which to look for the creation of lacustrine basins. And yet it is in this very locality that we find a continuous series of lakes possessed of a depth greater than we find in the river itself immediately adjacent. I have investigated and sounded some of these accumulations of water, and will now proceed to describe them in order, and thereafter deduce the conclusions which are directly suggested by the ascertained facts.

But before proceeding to discuss my own experiences, I ought to state first what was already known about these lakes—and it is not very much. The only traveller who has visited the region is M.V. Pjevtsoff, though he can only have seen the dunes at a distance. What he says about them is as follows:

> Southwest of the Jarkent-darja extends the lifeless desert which the natives call Kettek-schaari-kum. It is covered by gigantic accumulations of sand, lying almost north and south, and between them are sandy expanses, consisting of low, flat *barkhans*, which resemble waves of the sea. The stupendous sand ridges approach in several places almost to the very brink of the river, though in other places they are as much as 10 versts from it; everywhere, however, they are plainly visible from the road. It is not so very long since the wild camel used to frequent this desert, and the natives to hunt him in the autumn and winter, but ten years ago he disappeared and took up his habitat elsewhere. The last wild camel is reported to have been seen amongst the sand south-west of the village of Jangi-su. The native hunters are of opinion that these wild animals have travelled southwards down the lower Jarkent-darja (Tarim), and thence made their way up to the Tscherschen-darja to the stony, sandy desert which extends southwest of the locality of Vasch-schaari, where it is commonly reported that the wild camel is still to be found in large numbers. . . . .

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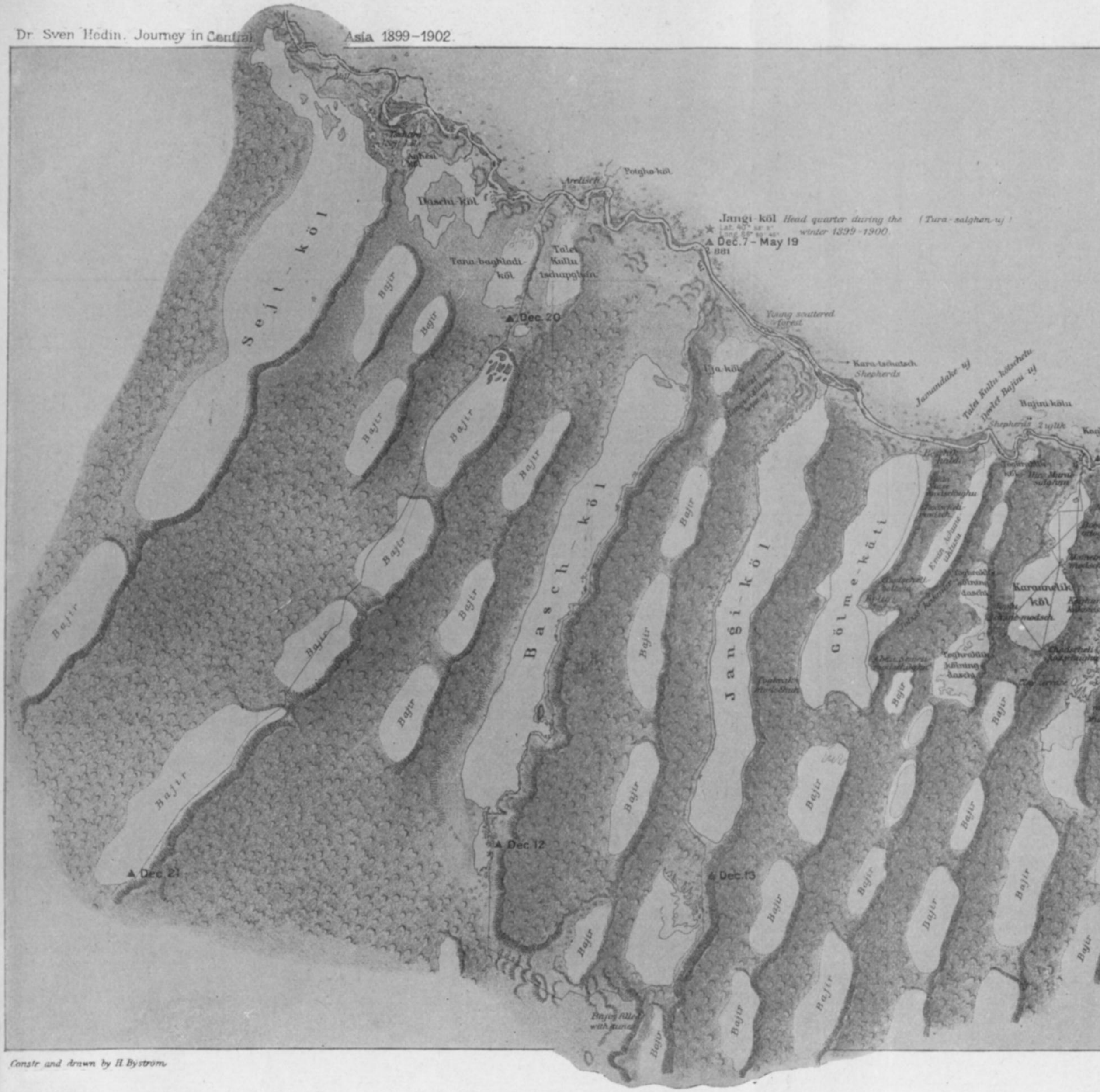
* The remarkable lakes which Dr. Sven Hedin discovered during his last visit to Central Asia are described in Vol. 1 of his " Scientific Results of a Journey in Central Asia, 1899-1902." His description and explanation of the existence of these lakes in the desert are given here so far only as to convey an idea of their present aspects and probable genesis (Chap. XVI, pp. 227-230, and Chap. XIX, pp. 305-306). A photographic reduction of sheet 12 of Dr. Hedin's Atlas shows the relations of the lakes to one another, the Tarim River, and the sand-dunes.

Dr. Sven Hedin. Journey in Central Asia 1899–1902.



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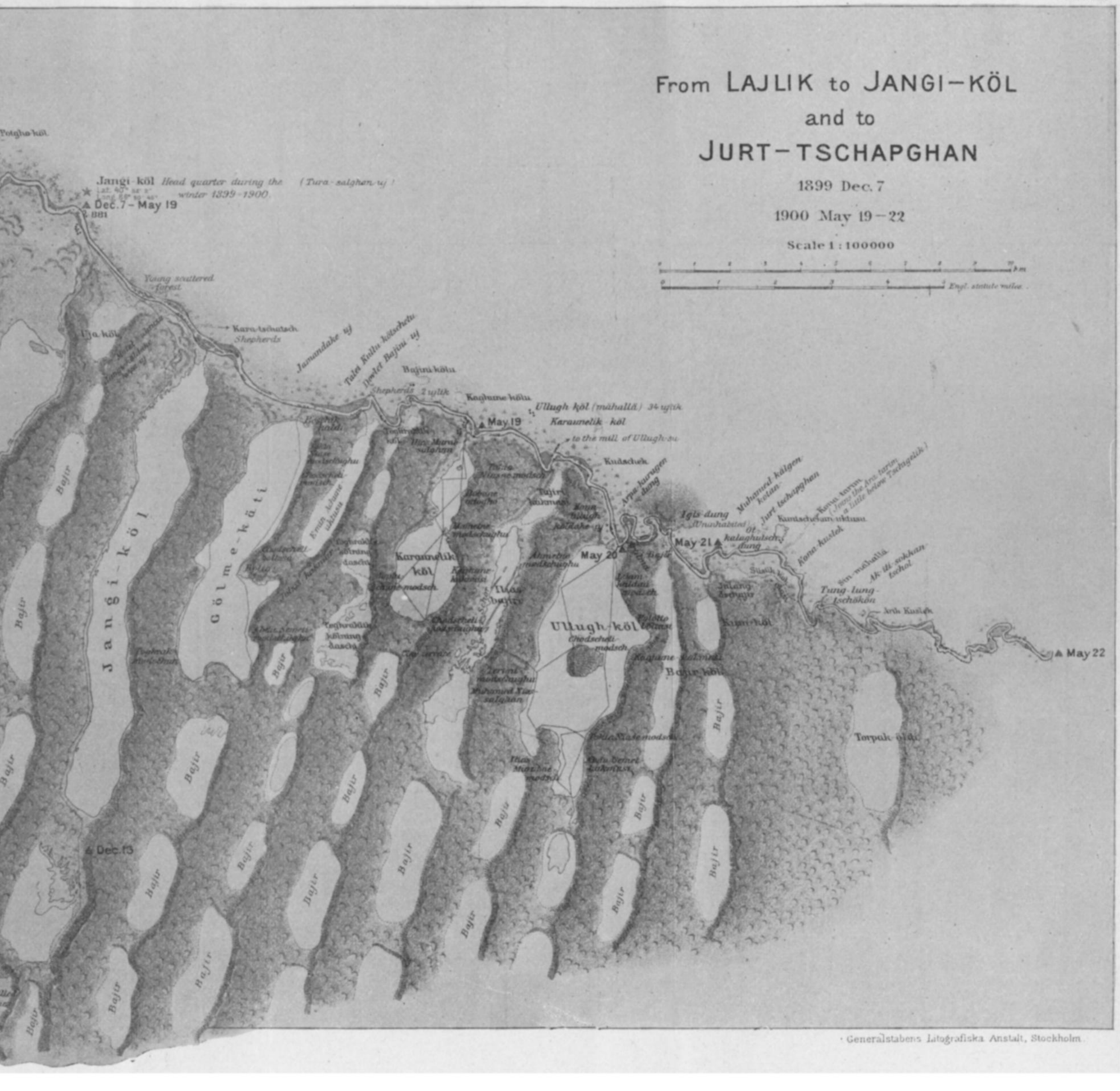

From LAJLIK to JANGI-KÖL and to JURT-TSCHAPGHAN

1899 Dec. 7

1900 May 19–22

Scale 1 : 100000

Generalstabens Litografiska Anstalt, Stockholm.

The inhabitants of the region described live principally by fishing, only in part by agriculture and hunting. They take their fish almost entirely in lakes artificially made in the depressions along the river banks, and fill these natural depressions by means of canals, 150 to 1,200 saschen long, which were dug by their ancestors. All these lakes have been full of water for many years, with the exception of the Ettek-bair, a lake about 8 versts in circumference, which was only filled in 1886. In the same locality there are counted a dozen such lakes, seven large ones and five small ones. They all lie on the right bank of the river, and their shores are overgrown with tall reeds. The largest lake, Jangi-kul, is about 15 versts long by 2 versts broad, and its' depth amounts to 3 saschen. The next largest, Basch-kul, is 12 versts long, 1 verst broad, and 3 saschen deep. The area of the other five large lakes is only about one-half the area of Jangi-kul; while the five small lakes measure each one to three versts in circuit.*

All these lakes are cut off from the river, though each has communication with it by means of its inflow canal, but outflow they have none. All the inflow canals are stopped with earthen dams, and are only opened periodically to let in fresh water from the Jarkent-darja just before the autumn floods. The inflowing currents bring with them into the lakes large quantities of fish; as soon as the river begins to drop, the canals are closed and the fish retained in the lakes. Water is let into the small lakes every second year, and into the large ones every third or fourth, and in some cases every fifth year. In the year when water is not let in, the volume of the lake decreases a little, and its water acquires a slightly brackish flavour, and with each year that the lake remains without a fresh inflow the salinity increases, until in the fifth year it is extremely bitter, and very disagreeable to the taste. Notwithstanding this great salinity, all the species of the fish that exist in the Jarkent-darja—*Nemachilus yarkandensis*, *Aspiorrhynchus Przewalskii*, *Schizostorax Biddulphi*, *Diptychus gymnogaster*—are found in these lakes. The lakes are divided amongst the inhabitants of the adjacent villages, each lake having its recognized owners, apart from whom nobody else has any right to fish there.

Then follows an account of the way in which the fish are caught. This description applies to 1890. Since then many inhabitants have given up fishing for agriculture. In the next few pages we shall see what the country looked like ten years later.

The first lake is the Teis-köl, which differs from its sister lakes in not being immediately surrounded by desert sand. Above this there are said to exist two depressions, Ettek-bajir and Kaltschini-bajiri, though neither contains water. Thus the first real desert lake is the Tus-alghutsch-köl, connected with the river by a canal (dry on 7th December), which winds through the reed-beds and has a hut beside it. This lake is said to be now kept cut off from the river, even at the time of high flood, owing to its mouth having been stopped up with branches, brushwood, and clay. The fish which are imprisoned in it are said to become fatter and to acquire a better flavour after the water has in great part evaporated, and the rest of it thus becomes slightly salt. In the winter the fish are taken in nets let down through holes hewn in the ice, the fish being driven into them by the men stamping and jumping on the frozen surface of the lake. In the summer the fish are caught from canoes. The lake, which is entirely surrounded by high barren sand-dunes, is said to attain a depth of three fathoms (kulatsch—the distance between the finger-tips when the arms are stretched out at full length). Nine families who formerly dwelt on its shores abandoned their huts in 1892 and flitted over to the left bank of the Tarim in order to carry on agriculture. The name Tus-alghutsch-köl conveys implicitly an indirect explanation: it means the Lake whence People Fetch Salt. Possibly its shores are saliferous. In area the lake is very small, and on 7th December it was entirely frozen over.

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* 1 saschen (sagena) = 7 feet. 1 verst = 3,500 feet.

The next lake is the Sejt-köl, connected with the river by three canals (utschu or aghsi), now stopped up. All three canals have forced their way through the sand-dunes, though the immediate banks of the middle one and the lowest are quite flat and overgrown with reeds. The lowest, when open, turns a mill. The northern portion of the lake lies for some distance parallel with the river, and so close to it that the two upper canals are each only a couple of hundred meters long. But, as was well seen from the top of the dunes, not far short of 100 m. high, on the east shore of the Sejt-köl itself, the larger portion of the lake extends S. 27° W., and resembles a fiord penetrating between mountains of sand. A long way off was observed a *bughas* (neck or contraction) between two projecting headlands, and beyond that a fresh expansion terminated towards the south by relatively low sand-dunes.

Strange to say, the natives everywhere asserted that the lakes are "artificially made." According to them, long, long ago canals were dug, and these were widened by the high flood-water, and in this way the depressions, which already existed among the sand-dunes, became gradually filled; and in part the sand was even thrust back by the encroaching water. This simple explanation can, of course, only be partially correct. That the depressions have not been artificially made is perfectly self-evident; they existed, indeed, before the Tarim ever flowed through that part of the country. That they have been filled and are kept filled with water from the Tarim is equally clear, and will shortly be sufficiently proved on the basis of exact measurement. On the other hand, it is not likely that all these connecting channels have been made by human agency; it is more likely that the river, by shifting to the right, and in consequence of its overflowing, has carved paths for itself into the depressions. But of this more later on.

At the foot of the vast accumulation of sand on the east shore of Sejt-köl there is a village of the same name, but its huts, built of poles and reeds towards the end of the seventies, now stand empty and deserted. The twenty-three families who inhabited them flitted, like the twenty-five families of Teis-köl, to Ak-tarma, on the great highway, in 1892. The reason of their changing their habitation was an outbreak of smallpox (tschätschäk), which raged in this district and decimated the inhabitants. The same visitation having ravaged all the villages alongside these lakes, the survivors were ordered by the Chinese authorities to flit over to the left bank of the river and devote themselves to agriculture, especially the growing of wheat, and to pastoral pursuits, more particularly the breeding of sheep. Previous to that time they had lived almost entirely upon a fish diet and by fishing. The soil does not, however, appear to be very favourable for cultivation, and the harvest does not yield sufficient for the people's needs. This is indeed strange, for one would think that in this locality of all others the irrigation of the fields would not be attended with any special difficulties.

Although a few well-to-do families own as many as 1,000 sheep, most of them possess barely 100 each. As a rule, they have to procure part of their supplies of flour from Korla, purchasing it by the barter of their sheep. The deserted villages are not occupied, even in summer; the people, who are few in number, are still afraid of infection, although they are said to have been vaccinated by the authorities. When the former villagers visit the lakes for the fishing in the summer they prefer to spend their nights in the open air; for fish still continues to form an essential part of their food—indeed, without it they could not exist. The inhabitants of the whole of this region call themselves Loplik—*i.e.*, people from Lop, just as the inhabitants of Kaschgar and Tschertschen call themselves respectively Kaschgarlik and Tschertschenlik. It is precisely in this region that the ancient name of Lop has ineradicably rooted itself.

Generally speaking, the dunes do not advance right up to the shores of the Sejt-köl, but are separated from them by a narrow strip of ground overgrown with reeds and tamarisks, with an occasional poplar. Thus the ground upon which the dunes stand lies somewhat higher than the level of the lake, though, on the other hand, it is to be noted that the lake has been shrinking and its *niveau* falling since its feeding-canals have been closed. Although the depth is said to reach 4 fathoms, it is, as a rule, much less. In the northern part of the lake there are some small sandy islands. The lake was frozen over from end to end, but it was only along the shores that the ice bore. The northeastern shore of Sejt-köl was studded with a great number of small, shallow pools. To ride from one end of the lake to the other took a horseman who was sent there at a later date an hour and a half of hard riding. Beyond and in the line of the lake's south-southwest continuation he discovered three depressions, separated from one another by "thresholds" of sand. * * *

For the sake of clearness it is well to gather up the principal results to which the above inquiry has led.

Between Karaul and Basch-arghan there is a chain of lakes, at least 35 in number.

They are fed by the Tarim through connecting channels.

Consequently they possess fresh water, which becomes slightly brackish when their connection with the river is severed, but is, owing to its stationary condition, as clear as crystal.

Their existence proves that the strip of land along the right bank of the Tarim lies at a lower level than the river.

Each lake occupies an independent depression lying between two elongated dunes.

Each of these depressions is deepest in its southeast part, and has a deep trench along the leeward slope of the dune on its eastern shore.

The western and northern parts of each lake are shallow.

The farther down the river the lakes lie, the greater grows their maximum depth, but the less their mean depth.

As a rule, the breadth increases, and the length decreases, the farther the lakes lie down the river. The proportion of length to maximum breadth is 8.0:1 in the Basch-köl and 2.8:1 in the Begelik-köl.

In three lakes that were sufficiently measured, the volume increased the farther the lake lay down the river. This is, however, an apparent law merely, and is simply due to the lakes selected. If we take the mean depth of the Jangi-köl as equal to that of the Karaunelik-köl, its capacity will be 120 million cubic meters.

The sides of each lake-basin are cemented by matter partly of fluvial, partly of æolian origin.

Beyond the inner—that is to say, the south-southwest—end of each lake, there is a bajir or depression exhibiting the same characteristics as the lake-basin itself, except that it contains no water. If there is water, the depression is called daschi, or "salt-pool."

The size of the connecting channels is proportional to that of the lake. Sometimes there are two, and even three canals. The length of the canals which feed the lower lakes appears to be greater than the length of those which feed the upper lakes.

All the lakes receive an inflow of water at the periods of high water, unless their canals are dammed by the natives or the lakes are isolated by a change in the course of the river.

In their topography the lakes reproduce the contours partly of the adjacent sandy desert, partly of the substratum.

The depressions were originally caused by wind-erosion, and their situation in the trenches of the substratum—*i. e.*, the everywhere predominant direction of their major axis from north-northeast to south-southwest, was originally caused by the prevalent wind blowing more or less at right angles to the main axis of the dunes.

Several of the lakes are contracted and narrow in the middle—a result attributable to the festoon arrangement of the dune-chains.

The lakes are of no great age, because the river itself has not long flowed through that region.

On both sides of each lake, east as well as west, there is generally a narrow strip of vegetation—the former owing its existence to the protection it enjoys against the wind, the latter to the wide berth afforded in consequence of the drift sand having been blown away by the wind, so that it does not smother the vegetation. This vegetation has been brought to these regions, which formerly were absolutely sterile, by the waters of the Tarim.

The lakes are full of fish, and fishing is carried on in several of them, though, since the natives have devoted themselves to agriculture, not to the same extent as formerly.

The highest dune I measured in this region had an altitude of 89.5 m. and the greatest depth sounded amounted to 14.0 m. (at Markat). Thus the greatest vertical difference of elevation is 103.5 m.—in fact, this was the greatest vertical difference of elevation I measured throughout the Lop country. It is, of course, possible there may be an even greater depth locally in one or other of the lakes, and that one or other of the dunes may stand a little higher, but the difference will in no case exceed a couple of meters or so above the 103 m.

As regards the future of these lakes, it may be taken for granted that they are doomed to perish, either through the advance of the dunes or the instability of the river. Their existence is in any case precarious, and represents merely a passing phase in the history of the development of the lower Tarim.

If through any cause they should disappear, it would result in an increase in the extent and volume of the Kara-Koschun. Their enlargement, being a consequence of the raising of the river-bed, has resulted in the diminution of the area of the Kara-koschun during the period in which it has been subject to observation.